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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/674,821	04/20/2001	David S. Levy	A31657-PCT	5058

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BAKER & BOTTS
30 ROCKEFELLER PLAZA
NEW YORK, NY 10112

EXAMINER
KIANNI, KAVEH C

ART UNIT	PAPER NUMBER
2877	

DATE MAILED: 07/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)	
	09/674,821	LEVY ET AL.	
	Examiner	Art Unit	
	Kevin C Kianni	2877	

-- The MAILING DATE of this communication appears n the cover sheet with the corresp ndence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-17 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-17 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 20 April 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 11
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over combination of Madsen (US 5953467) and Besse (US 5689597).

Regarding claim 1, Madsen teaches a multimode interference based coupler (shown at least in fig. 1, see last 6 lines of abstract) comprising:

(a) at least one input access waveguide A for inputting an input optical signal into a first end of the multimode interference based coupler (see fig. 1, item input waveguide A; also col. 3, lines 49-50 and col. 1, lines 55-61);

(b) at least one output access waveguide for outputting images of the input optical signal from a second end of the multimode interference based coupler (see fig. 1, item output waveguide B; also col. 3, lines 49-50 and col. 1, lines 55-61); and

(c) a multimode region coupling the one or more input waveguides to the one or more output waveguides through which the input optical signal propagates from the first end to the second end along a propagation axis and is reimaged at the one or more output access waveguides (see fig. 1, items input/output waveguides A,B,C, and D; also col. 3, lines 49-50 and col. 1, lines 55-61), wherein

(i) the multimode region has two opposing sidewalls which define a width of the coupler at each point along the propagation axis (shown at least in figures 1 and 7, items sidewalls of coupler(s) which define a width of the coupler—i.e., 14-- at each point along the propagation axis; see also col. 7, lines 17-34);

(ii) at least one of the sidewalls of the multimode region has a non-linear taper inward toward the opposing sidewall (see fig. 1, item coupler 14, in which its region has a non-linear taper inward toward the opposing sidewall, both at top and bottom); and

(iii) the sidewalls are smoothly continuous with continuous derivates along the propagation axis (see fig. 1, item coupler 14 having a curve-like continuous derivates, at top and bottom along the propagation axis).

However, Madsen does not specifically teach wherein the above tapered sidewalls have an average width along the propagation axis that is less than the average width had the sidewalls both been straight lines. This limitation is more specifically taught by Besse. Besse teaches a multimode interference based coupler (see abstract) that includes the above limitation (show at least in figures 2, 4 and 5; see also abstract and col. 9, line 61-col. 10, line 29+; wherein, using equation 2, the geometric shaping or reshaping of the length of the coupler, where the length of the coupler is reduced with respect to the width of the coupler would include the above limitations). Thus, Besse provides optimizing signal intensity and phase distribution of MMI couplers by geometrical shaping of couplers (see col. 4, lines 21-28). Therefore, it would have been obvious to a person of ordinary skill in the art when the invention was

made to modify Madsen's coupler 14, using Besse's equation 12 with respect to geometric shaping of coupler in order to produce an MMI coupler that includes the above limitation, since the resultant MMI would provide gain equalization in add/drop optical channel in multi-channel MMI optical communications (see col. 1, lines 5-8).

Regarding claim 2, as stated in rejection of claim 1, Madsen further teaches wherein both sidewalls have non-linear inward tapers toward the opposing sidewall with the taper of both sidewalls being symmetric reflections about a center line along the propagation axis (see fig. 1, item coupler 14, in which its region has a curved-like non-linear taper inward toward the opposing sidewall being symmetric reflections about a center line along the propagation axis).

Regarding claim 3, as stated in rejection of claim 1, Madsen further teaches wherein the tapers have a single extrema within the multimode region where the derivative along the propagation axis is zero (see fig. 1, item coupler 14, in which continuous curve/derivative where the curvature of the coupler ends, there would be no more curve/derivative and thus the derivative is zero).

Regarding claim 4-11, as stated in rejection of claims 1 and 3, Madsen further teaches wherein the coupler has equal widths at the first end and the second end, wherein the two sidewall tapers are symmetric about a center line, orthogonal to the propagation axis, midway between the first end and the second end of the coupler (see

fig. 7, items symmetric sidewalls, normal to propagation path), wherein the input and output access waveguides couple to the multimode region at an angle so to match a local taper angle at the ends of the MMI region (see fig. 8, items angled waveguides matching the tapered sidewalls 80), wherein the taper shape is parabolic, hyperbolic, elliptical or cosinusoidal (see fig. 1, in which the taper shape is parabolic, hyperbolic, elliptical or cosinusoidal).

Regarding claim 12, as stated in rejection of claim 1, Madsen further teaches wherein the taper maximum curvature, as characterized by the second derivative of the taper along the propagation axis is limited such that the adiabaticity of guided modes is substantially maintained (see fig. 1, item coupler 14, in which the coupler 14 taper maximum curvature shows the maintenance of the adiabaticity of guided modes as characterized by the second derivative of the curved-like taper along the propagation axis).

With respect to claim 13, Madsen teaches a 2x2 multimode based power splitter (shown at least in fig. 1 and 7-8, see last 6 lines of abstract; wherein the MMI coupler is a splitter/combiner coupler) comprising:

(a) two input access waveguides for inputting an optical signal into a first end of the power splitter (see fig. 6, item input waveguides inputting an optical signal into a first end of the power splitter 50/10; see col. 4, lines 59-67; wherein the MMI coupler is a splitter/combiner coupler shown in fig. 1 and 12-13);

(b) two output access waveguides for outputting two images of the input optical signal from a second end of the power splitter (see fig. 6, item output waveguides inputting an optical signal into a first end of the power splitter 50/10; see col. 4, lines 59-67, wherein the MMI coupler is a splitter/combiner coupler shown in fig. 1 and 12-13); and

(c) a multimode region coupling the two input waveguides to the two output waveguides through which the input optical signal propagates along a propagation axis and is reimaged as two images of the input signal (see fig. 6, item input-output waveguides; also col. 4, lines 59-67), wherein

(i) the multimode region has two opposing sidewalls which define a width of the power splitter at each point along the propagation axis with the width of the first end and second end being substantially equal (shown at least in figures 1 and 7, items sidewalls of coupler(s) whit equal widths at the first and second ends of the coupler—i.e., 14-; see also col. 7, lines 17-34); and

(ii) the sidewalls are symmetrically tapered inward toward each other around a center line of the propagation axis wherein the taper is a continuous curve having a continuous derivative along the propagation axis with a single extrema, within the MMI region where the derivative along the propagation axis is zero (see fig. 1, item coupler 14 having to/bottom symmetrically tapered and curve-like continuous derivates which in which continuous curve/derivative where the curvature of the coupler ends, there would be no more curve/derivative and thus the derivative is zero).

However, Madsen does not specifically teach wherein the images having approximately half the intensity of the input signal. This limitations are more specifically taught by Besse. Besse teaches a multimode interference based coupler with controllable output image intensities that includes the above limitation (see abstract and col. 2, lines 11-12; also col.. 4, lines 21-29); Thus, Besse provides optimizing signal intensity and phase distribution of MMI couplers by geometrical shaping of couplers (see col. 4, lines 21-28). Therefore, it would have been obvious to a person of ordinary skill in the art when the invention was made to modify Madsen's coupler 14, using Besse's equation 12 with respect to geometric shaping of coupler in order to produce an MMI coupler that includes the above limitation, since the resultant MMI would provide gain equalization in add/drop optical channel in multi-channel MMI optical communications (see col. 1, lines 5-8).

Regarding claim 14, as stated in rejection of claim 13, Madsen further teaches wherein the taper is symmetric about a center line orthogonal to the propagation axis midway between the first end and the second end of the power splitter (see fig. 7, items symmetric tapered sidewalls are normal to propagation path at the ends of the coupler).

Regarding claims 15-17, the arguments presented in rejection of claims 11, 9 and 12, above, are, consecutively, analogous in rejection of claims 15-17.

R sponse to Arguments and Amendment

3. Applicant's argument filed on June 20, 03 have been fully considered but they are not persuasive.

Applicant alleges (page 2, parag.-page 3) that Madsen does not teach the claim limitations of claims 1 and 13. Examiner responds that applicant does not specifically state which limitations of claims 1 and 13 are not taught by the combination of Madsen and Besse and the reasons why the combination fails to teach. However, applicant has particularly emphesised by high lighting portions (page 2) of claim 1 and 13 questioning the teachings of Madsen or combination of Madsen and Besse the limitations 'a nonlinear taper inward toward the opposing sidewall' and 'sidewalls symmetrically tapered inward toward each other around a center line of the propagation axis where the taper is a continuous curve. The examiner responds that the applicant's use of the phrase word 'nonlinear' is interpreted by the examiner as curved in which the coupler tape tapers in curve fashion downward and then upward which is shown by the applicant in figures 3 and 6 and discussed in pages 5-14. First, as shown by Madsen in at least fig. 1-2, coupler 14 or 15 has a nonlinear/curved taper inward toward the opposing sidewall around a center line of the propagation axis where the taper is a continuous curve and in which the input/output signals A/B propagate. Second, Besse's teachings too include the above limitations except that the taper is not curved and rather it tapers in a straight line down and then in a straight line up. The shape of the Besse's tapered coupler, shown in at least fig. 2, to be adjusted so as it would be curved like is a matter of obvious design choice since it has been held that the provision

of adjustability, where needed, involves only routine skill in the art. In re Stevens, 101 USPQ 284 (CCPA 1954). Thus, Madsen or the combination of Madsen and Besse teach the above limitations.

The examiner advises the applicant that the scope of claims 1 and 13 need to be narrowed in order to make the case allowable.

THIS ACTION IS MADE FINAL

4. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Kianni whose telephone number is (703) 308-1216.

The examiner can normally be reached on Monday through Friday from 8:30 a.m. to 6:00 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font, can be reached at (703) 308-4881.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks
Washington, D.C. 20231

or faxed to:

(703) 308-7722, (for formal communications intended for entry)

or:

(703) 308-7721, (for informal or draft communications, please label "PROPOSED" or "DRAFT")

Hand delivered responses should be brought to Crystal Plaza 4, 2021 South Clark Place, Arlington, VA., Fourth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is (703) 308-0956.

Kevin Cyrus Kianni
Patent Examiner
Group Art Unit 2877

Frank Font
Supervisory Patent Examiner
Group Art Unit 2877

December 17, 2002